ADDITIONAL COUNTS AND RECORDS OF FLOCK COMPOSITION OF CARNABY'S COCKATOO (*CALYPTORHYNCHUS LATIROSTRIS*) AT TWO OVERNIGHT ROOSTING SITES IN METROPOLITAN PERTH

By P.F. BERRY
Honorary Associate, Western Australian Museum
(padberry@bigpond.net.au)

and

M. OWEN
(goffmarg@bigpond.net.au)

ABSTRACT

Daily counts of Carnaby's Cockatoo from April 2006 to August 2009 at an overnight roosting site centred at Hollywood Private Hospital in the western suburbs, were made over a period of 41 consecutive months. Data from the first 13 months were published in 2008. Data from the 28 subsequent months confirm a clear seasonal trend in abundance. Highest numbers were recorded from February to June followed by a rapid decline in July with no birds roosting in September and October. Thereafter there was a progressive build-up in numbers throughout the summer to a peak in February, with maximum numbers of >400 birds.

Counts made at the only other known roosting site in the western suburbs, centred at nearby Perry Lakes, indicate that from February a progressively increasing proportion of the local cockatoo population roosts at the Perry Lakes site in autumn and winter rather than at the Hollywood site. The total numbers of birds remaining in the western suburbs from February to July is thus higher than previously reported based only on counts at the Hollywood roosting site. The mean numbers at both roosting sites combined show that a population of around 250–300 birds is present for at least four months of the year (March to June) and over around 150 birds for at least 7 months (Jan. to July). However, between March and June maxima ranged between about 400 and 500 birds.

The additional data confirm earlier findings that the flocks

of Carnaby's Cockatoo comprised a mean of approximately 60% pairs and 40% triplets (pair and fledged young that was still being fed) over the year. However, the data for 2007/08 and 2008/09 show a progressive monthly increase in the proportion of pairs and correlated decrease in proportion of triplets from December to July/ August. This may reflect an exodus of parents to breed, leaving behind juveniles which then form non-breeding pairs.

INTRODUCTION

Carnaby's Cockatoo (*Calyptorhynchus latirostris*) is endemic to the south-west region of Western Australia. It is considered Endangered under IUCN criteria (Burbidge 2004) and is currently listed as a threatened species under State and Commonwealth legislation, due to an apparent rapid decline in its abundance and distribution associated with land clearance in the wheatbelt and the Swan Coastal Plain. It breeds largely in the wheatbelt and moves to the Swan Coastal Plain to feed in the non-breeding season (Davies 1966; Saunders 1977, 1980, 1990; Saunders and Ingram 1995, 1998). Clearing of native vegetation on the Swan Coastal plain, particularly of Banksia/Tuart Woodland used by Carbaby's Cockatoo for feeding, has been extensive in recent years and continues at an accelerating rate. Government of Western Australia (2000) estimated that 28% of the original vegetation of the Perth Metropolitan Region remained in 2000. This would have declined since then.

This study of Carnaby's Cockatoo, in its non-breeding range in metropolitan Perth, is the first attempt to quantify its abundance on an ongoing basis, with daily counts now having been made over 41 consecutive months at a habitual overnight roosting site in Hollywood (Nedlands). The objectives are to provide a quantitative record of its status and to contribute to knowledge about its resource requirements and behaviour, particularly in relation to natural and man-made changes in the urban environment of Perth's western suburbs.

Daily counts of Carnaby's Cockatoo made from April 2006 to April 2007 at an overnight roosting site centred at Hollywood Hospital in the western suburbs, as well as concurrent records of flock composition, have recently been published (Berry 2008). Additional daily counts from the Hollywood site made between May 2007 and August 2009 are reported here, as well as counts made on between 4 and 15 days a month from a second roosting site centred at Perry Lakes that were started in February 2008. The Hollywood and Perry Lakes roosting sites are 2.7 km apart and are the only

known roosting sites in the western suburbs of Perth. The total number of birds roosting at both sites is thus thought to approximate the total number of Carnaby's Cockatoo in the western suburbs on any day.

METHODS

The methods used to count Carnaby's Cockatoo are as described previously (Berry 2008).

RESULTS

The clear trend of mean and maximum seasonal abundance recorded in 2006 and 2006/07 was repeated at the Hollywood roost site in 2007/08 and 2008/09 (Table 1, Figures 1 and 2). After a rapid progressive increase starting in November, mean monthly numbers peaked in March or April (222, 291, 197, & 262) followed by a rapid decline with lowest numbers of birds recorded from August to October (Figure 1). Maximum numbers of birds were recorded at the Hollywood site in January/February (331), March (676), April (479) and May (450), (Figure 2). In August 2009 there was an apparent influx of birds to the western suburbs that roosted at the Hollywood site.

From February 2008, additional counts were made on between 4 and 15 days a month by Margaret Owen at the roosting site near Perry Lakes. Monthly mean and maximum counts over both years show an increase in numbers counted at the Perry Lakes site with a corresponding decline at the Hollywood site. This indicates that a pro-gressively increasing proportion of the local cockatoo population roosts at the Perry Lakes site in autumn and winter (Table 1, Figures 3 and 4) and that the population remains in the western suburbs in greater numbers for longer than had been thought, based on Hollywood site data alone. The mean numbers counted at both roosting sites combined indicate that a population of around 250–300 birds is present in the western suburbs for at least four months of the year (March to June) and over around 150 birds for at least 7 months (Jan. to July) However, between March and June maxima ranged between about 400 and 500 birds. (Table 1, Figures 5 and 6).

As in 2006/07 the composition of flocks in 2007/08 and 2008/09 consistently comprised an annual mean of approximately 60% pairs and 40% triplets (pair and fledged young that was still being fed) (see Table 2). A variable low proportion of single birds recorded is thought to represent individuals that are temporarily separated from their mates or parents. However, on a monthly basis an increase in the percentage of pairs and correlated reduction in percentage of triplets was evident, particularly over the months when a good sample size was achieved. This trend is particularly clear in 2008/09 (see Table 3 and Figure 7).

Table 1. Roost counts of Carnaby's Cockatoos at overnight roosting sites at Hollywood (April 2006–August 2009) and Perry Lakes (February 2008–August 2009). (Numbers in brackets = days counted).

	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug
Hollywood Mean												
2006	–	–	–	–	–	–	–	222.0	205.0	63.0	27.0	0.1
2006/07	0	0.3	6.0	54.0	138.0	203.0	291.0	161.0	72.2	96.6	8.5	0
2007/08	0	0	3.4	25.2	102.1	176.3	196.6	109.1	17.6	57.5	23.8	1.1
2008/09	0	0	19.3	32.5	119.1	137.9	209.1	262.1	128.8	88.9	41.1	98.2
Hollywood Maximum (Numbers of days counted each month at Hollywood site in brackets).												
2006	–	–	–	–	–	–	–	250 (5)	450(29)	239(21)	166(16)	2 (17)
2006/07	0 (26)	4(31)	37(18)	183(26)	230(19)	321(26)	676(21)	387(22)	233(23)	339(15)	60 (17)	0(17)
2007/08	0 (17)	0 (15)	16 (17)	98 (24)	331(24)	331(25)	319(23)	256(29)	232(25)	119(18)	78 (25)	10 (25)
2008/09	0 (20)	0 (26)	34 (10)	69 (30)	254(25)	368(27)	473(23)	479(25)	325(28)	311(30)	137(28)	188(29)
Perry Lakes Mean												
2007/08	–	–	–	–	–	9.5	52.9	133.6	260.1	212.6	140.90	74.50
2008/09	0	0	0	3.5	7.3	20.8	92.8	108.6	167.6	166.9	149.1	91.9
Perry Lakes Maximum (Numbers of days counted each month at Perry Lakes site in brackets).												
2007/08	–	–	–	–	–	19 (6)	108(10)	263 (8)	173 (8)	165 (7)	191(12)	190 (6)
2008/09	0	0	0 (2)	14 (4)	44 (6)	70 (4)	230(12)	192(13)	272(15)	225(13)	211 (8)	218 (9)
Hollywood + P. Lakes Mean												
2007/08	–	–	–	–	–	178.7	292.0	272.0	292.0	253.0	194.0	81.0
2008/09	0 (3)	0 (2)	19.3	23.5	140.3	153.0	239.6	351.9	287.9	234.1	195.4	210.6
Hollywood + P. Lakes Maximum (Numbers of coincident days each month on which there were counts at the Hollywood and Perry Lakes sites in brackets)												
2007/08	–	–	–	–	–	331 (3)	392 (7)	394 (8)	405 (8)	284 (7)	269(12)	200 (5)
2008/09	0 (3)	0 (2)	34 (2)	69 (4)	254 (6)	368 (4)	473 (8)	506(11)	486(15)	510(13)	235(8)	299 (9)

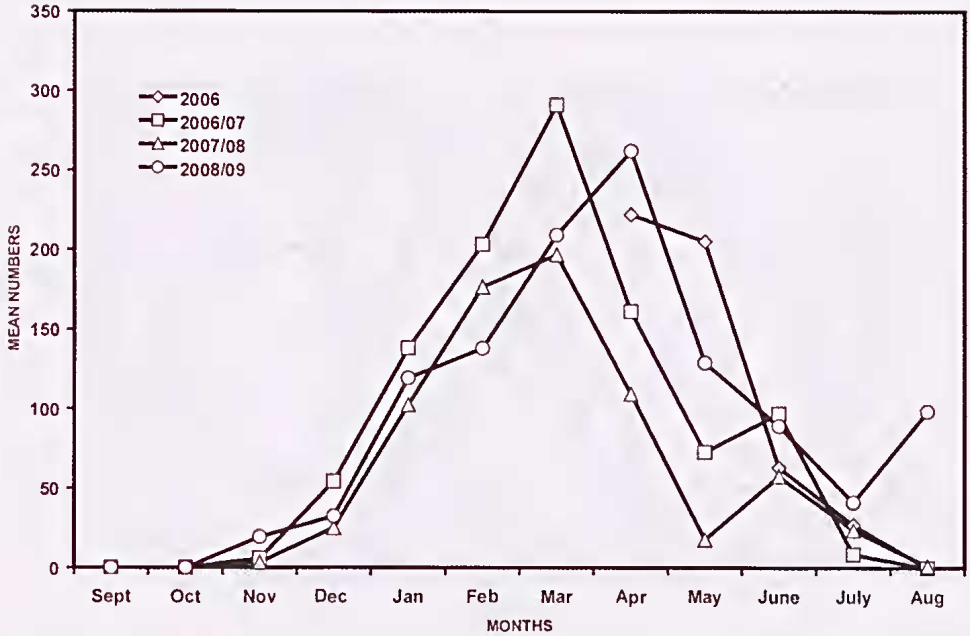

Figure 1. Mean numbers of Carnaby's Cockatoo at the Hollywood roost site over 41 consecutive months.

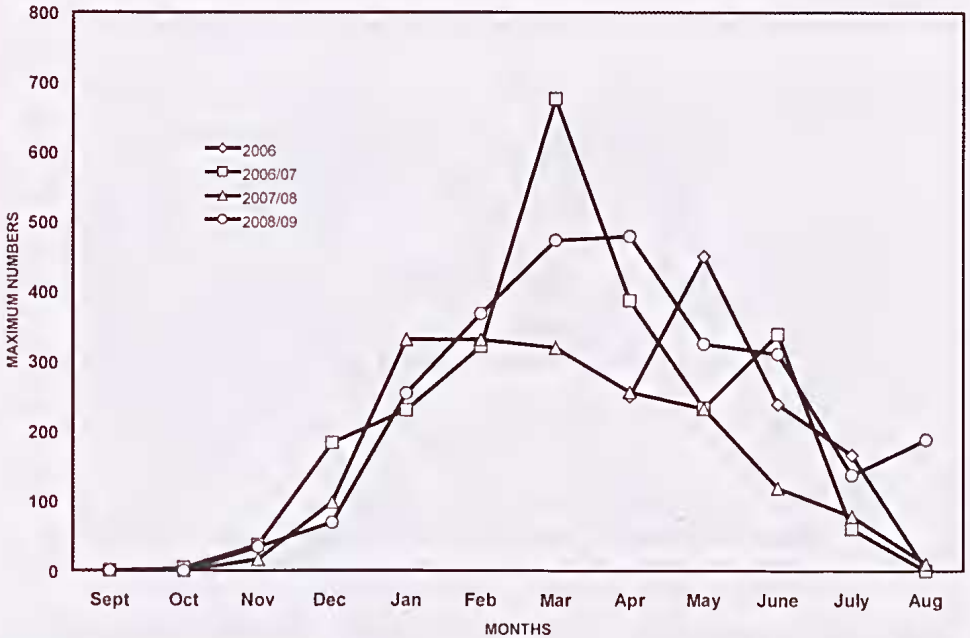

Figure 2. Maximum numbers of Carnaby's Cockatoo at the Hollywood roost site over 41 consecutive months.

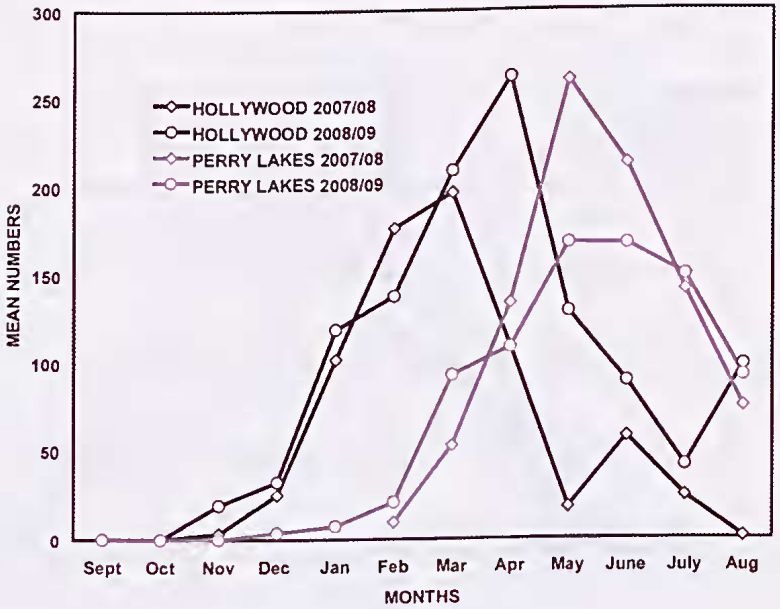

Figure 3. Mean numbers of Carnaby's Cockatoo at overnight roosting sites at Hollywood (September 2007–August 2009) and Perry Lakes (February 2008–August 2009).

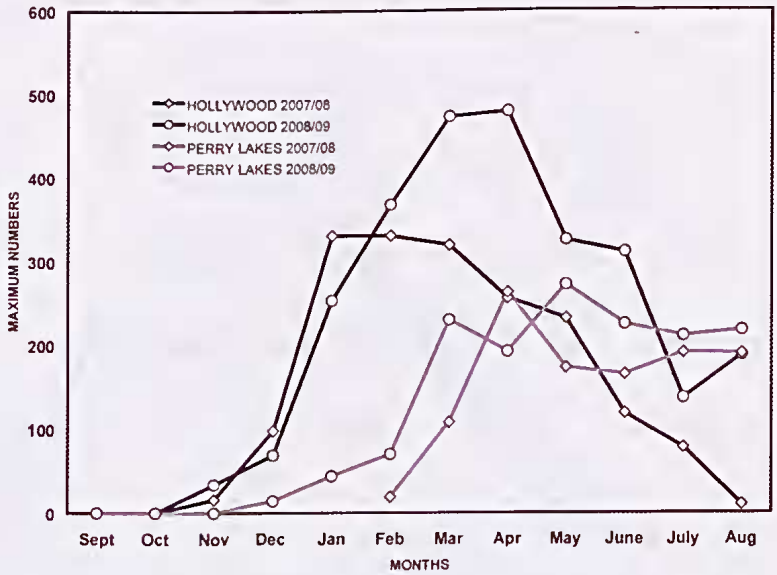

Figure 4. Maximum numbers of Carnaby's Cockatoo at overnight roosting sites at Hollywood (September 2007–August 2009) and Perry Lakes (February 2008–August 2009).

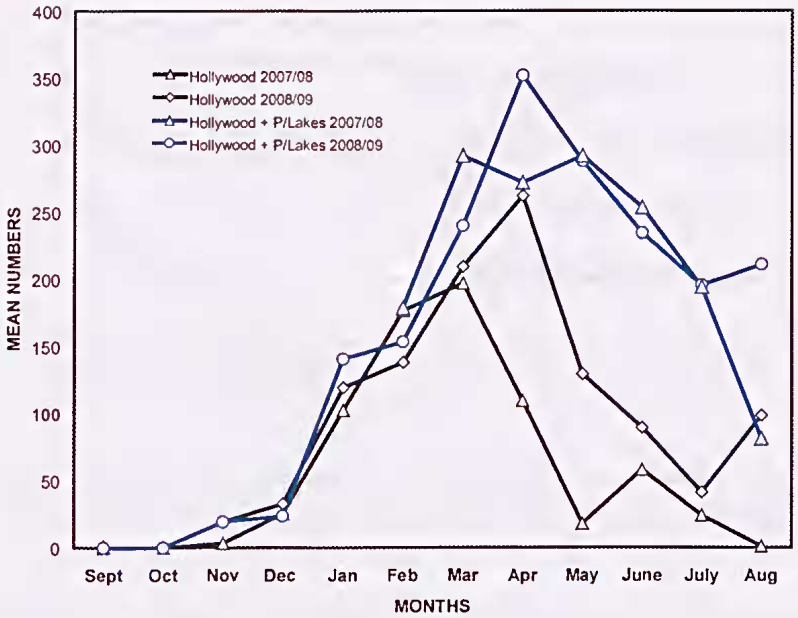

Figure 5. Mean numbers of Carnaby's Cockatoo at Hollywood and Hollywood plus Perry Lakes combined in 2007/08 and 2008/09.

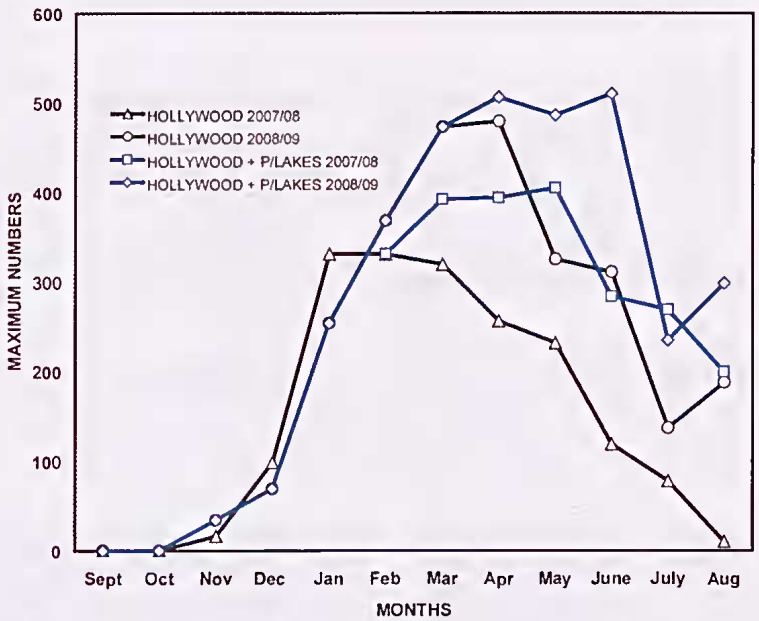

Figure 6. Maximum numbers of Carnaby's Cockatoo at Hollywood and at Hollywood plus Perry Lakes combined in 2007/08 and 2008/09.

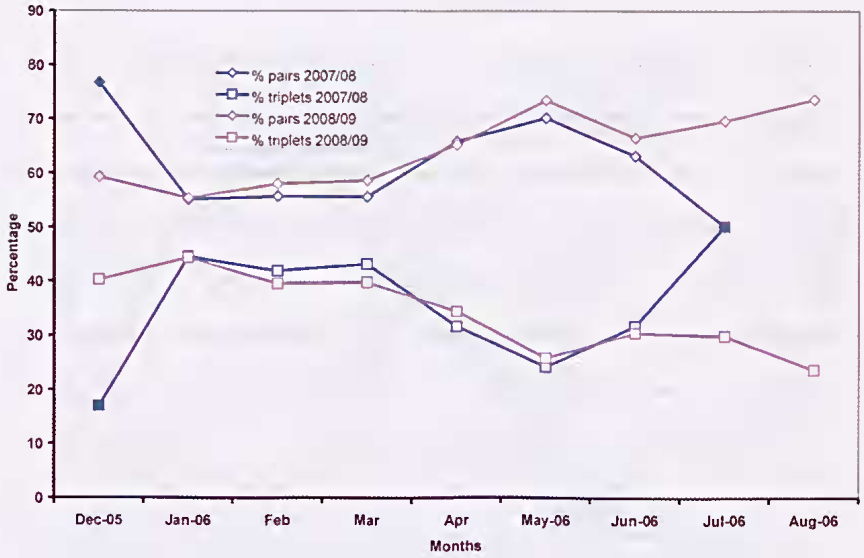

Figure 7. Monthly proportion of pairs and triplets (parents and juvenile) discriminated within flocks at the Hollywood roost site in 2007/08 and 2008/09. Solid points are months with fewer than 50 pairs/triplets recorded i.e. comparatively small samples (see Table 3).

Table 2. Mean annual flock composition of Carnaby's Cockatoo at the Hollywood Roost site

YEAR	mean % single birds	mean % pairs	mean % with juvenile (triplets)	n (singles, pairs or triplets counted)
May 06 - Apr 07	4	58	38	3859
May 07- Apr 08	3	60	37	1930
May 08 - Apr 09	2	60	38	1774
May 09 - Aug 09	3	69	28	810

That Carnaby's Cockatoo undergo possibly a complete moult while on the Swan Coastal Plain was confirmed photographically and is demonstrated by the ease with which 64 rectrices, primary and secondary feathers were collected between January and May beneath the roosting trees at the Hollywood site for DNA analysis.

Table 3. Numbers of single birds, pairs and triplets (parents and juvenile) discriminated within flocks roosting at the Hollywood roost site May 2006-Aug 2009.

2005/06	Dec-05	Jan-06	Feb	Mar	Apr	May	Jun	Jul	Aug	Totals
% single birds						4.6	0.9	0		
% pairs						59.4	60.9	62.7		
% triplets						36	38.2	37.3		
Numbers counted						453	699	110		1262
2006/07	**Dec-06**	**Jan-07**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul-**	**Aug**	
% single birds	2.4	5.6	4.5	5.8	7.0	(0)	(3.7)			
% pairs	60	55.3	58.8	53.8	54.5	(57.1)	(77.8)			
% triplets	37.6	39.1	36.7	40.4	38.5	(42.9)	(18.5)			
Numbers counted	170	486	1093	549	299	14	27			2638
2007/08	**Dec-07**	**Jan-08**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	
% single birds	6.7	0.7	2.8	1.6	3.0	6.0	5.5	7.1		
% pairs	76.6	54.9	55.5	55.4	65.7	70.0	63.0	50.0		
% triplets	16.7	44.4	41.7	43.0	31.3	24.0	31.5	50.0		
Numbers counted	30	286	456	612	469	50	108	28		2039
2008/09	**Dec-08**	**Jan-09**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	
% single birds	0.8	0.6	2.9	2	0.9	1.1	3.5	0.8	3.1	
% pairs	59.1	55.2	57.8	58.4	65	73.3	66.3	69.5	73.4	
% triplets	40.1	44.2	39.3	39.6	34.1	25.6	30.2	29.7	23.4	
Numbers counted	127	308	377	409	543	191	202	128	289	2574

DISCUSSION

Up until February the mean numbers of Carnaby's Cockatoo counted at the Hollywood roosting site are thought to approximate the size of the population present in the western suburbs. Thereafter, when they start to roost at Perry Lakes as well, the mean counts at the two roost sites combined better indicate the total size of the population present. Maximum counts are probably swelled by transient flocks, but the prolonged period (March to June) when between about 400–500 birds are present means that food resources are required to sustain populations of this magnitude. The consistency of the numbers of Carnaby's Cockatoos recorded in the western suburbs subpopulation also indicates that there is a correlation between numbers of birds present and food resources available. Presumably a balance is reached between food availability and numbers of birds supported. Why otherwise are flocks of thousands never recorded in the western suburbs as they are regularly at the Gnangara pine plantations (Johnstone and Kirkby 2008)?

In August 2009 the increase in the number of birds recorded roosting at the Hollywood site is interpreted as an influx to the western suburbs. Why they roosted at Hollywood and not Perry Lakes is unknown, but the most likely explanation is that their food resource was closer to the Hollywood roost. This large flock was seen feeding most evenings on the ground in Karrakatta cemetery on Norfolk Island Pine (*Araucaria heterophylla*) seeds which were present in great abundance (2009 appears to have been a mast year for seeding, R. Dixon, pers. com.). They also regularly fed on Tipuana (*Tipuana tipua*) and *Banksia praemorsa* seeds in the cemetery.

The most plausible explanation for the progressive monthly increase recorded in the proportion of pairs is that it is associated with departure of parents to breeding sites, leaving behind juveniles which then form non-breeding pairs. In 2007/08 and 2008/9 there is a sudden decrease in mean and maximum numbers roosting in the western suburbs in April and May respectively marking the beginning of an exodus (Figures 5 and 6). This correlates with an increase in the rate at which the proportion of pairs starts to increase (although this is in April in both years, see Figure 7). More work needs to be done on the age structure of birds within pairs and triplets to confirm this.

The decline in Carnaby's Cockatoo has been attributed largely to loss of feeding habitat available to the breeding population in the wheatbelt (Saunders 1977, 1980, 1990; Saunders and Ingram 1995, 1998a, 1998b). However, the most rapid and extensive clearing of the wheatbelt occurred in the 1930's and

although it continues to the present, it is at a much reduced rate. At the same time that the rate of clearing in the wheatbelt has been declining, clearing of native vegetation on the Swan Coastal Plain has accelerated, and continues to do so. It therefore seems highly probable that a progressive decline of food resources available in the non-breeding season is now also contributing to the decline in numbers. Breeding success is likely to be dependent on birds attaining a high condition level prior to breeding while in their non-breeding range on the Swan Coastal Plain. While on the Swan Coastal Plain, birds undergo a full or partial moult which would also have high nutritional cost. Thus quality of food resources and ability to harvest them efficiently (locally) without high energy expenditure on foraging is likely to be critical to the pre-breeding build-up of condition and ultimately to breeding success. Johnstone *et al.* (2005) have shown that the foraging distribution of Carnaby's Cockatoo is progressively changing, with expansion to the deep south west. In the absence of any other reasons for this, the most likely cause seems to be continuously declining food resources on the Swan Coastal Plain where most of the vegetation lost has been, and continues to be Banksia/Tuart Woodland and proteaceous heath favoured for feeding by Carnaby's Cockatoo.

In conclusion, the status of Carnaby's Cockatoo needs to be quantitatively monitored at strategically chosen sites. Because of its longevity this will need to be done in the long term (tens of years). The present indications are that the rate of clearing of native vegetation on the Swan Coastal Plain is adversely impacting survival of Carnaby's Cockatoo by depriving it of food resources. This effect could be compounded if recent proposals for large scale clearing of pine plantations, a major alternative food source, are implemented. The sub-population in the western suburbs is also facing continuous diminution of the remnant bushlands on which it depends. On a more positive note, Carnaby's Cockatoo is a highly adaptive and mobile species and would probably benefit from extensive plantings of food plants, both native and exotic, in urban and rural environments.

REFERENCES

BERRY, P.F. 2008. Counts of Carnaby's Cockatoo (*Calyptorhynchus latirostris*) and records of flock composition at an overnight roosting site in metropolitan Perth. *Western Australian Naturalist* **26**: 1–11.

BURBIDGE, A. A. 2004. *Threatened Animals of Western Australia.* Department of Conservation and Land Management: Perth.

DAVIES, S. J. J. F. 1966. The movements of the White-tailed

Black Cockatoo (*Calyptorhynchus baudinii*) in south-western Australia. *Western Australian Naturalist* 10: 33–42.

GOVERNMENT OF WESTERN AUSTRALIA 2000. *Bush Forever*. Volume 1, Part B, Table 4: page 83. Department of Environmental Protection, Perth, Western Australia.

JOHNSTONE, R., KIRKBY, T., STONE, P. and MINTON, C. 2005. White-tailed Black-Cockatoos: identification challenges and changes in distribution and status, and links with a community program – Cockatoo Care. *In*: GOLE, C. (Ed.). *Carnaby's Black-Cockatoo Future Directions Symposium*, Birds Australia Western Australia, Perth.

JOHNSTONE, R. and KIRKBY, T. 2008. Carnaby's Cockatoo (*Calyptorhynchus latirostris*) on the Northern Swan Coastal Plain (Lancelin–Perth) Western Australia. Unpublished report to the Department of the Environment, Water, Heritage and the Arts.

SAUNDERS, D.A. 1977. The effects of agricultural clearing on the breeding success of the White-tailed Black-Cockatoo. *Emu* 77: 180–184.

SAUNDERS, D. A. 1980. Food and movements of the short-billed form of the White-tailed Black Cockatoo. *Australian Wildlife Research* 7: 257–269.

SAUNDERS, D. A. 1990. Problems of survival in an extensively cultivated landscape: the case of Carnaby's cockatoo *Calyptorhynchus funereus latirostris*. *Biological Conservation* 54: 277–290.

SAUNDERS, D. A. and INGRAM, J. A. 1995. *Birds of Southwestern Australia: an Atlas of Changes in Distribution and Abundance of the Wheatbelt Avifauna*. Surrey Beatty and Sons, Chipping Norton, NSW.

SAUNDERS, D. A. and INGRAM, J. A. 1998a. Factors affecting survival of breeding populations of Carnaby's Black-Cockatoo *Calyptorhynchus funereus latirostris* in remnants of native vegetation. pp. 249–258, *In*: *Nature Conservation: the Role of Remnants of Native Vegetation*, eds. SAUNDERS, D.A., ARNOLD, G.W., BURBIDGE, A.A. & HOPKINS, A.J.M.. Surrey Beatty & Sons, Chipping Norton, NSW.

SAUNDERS, D. A. and INGRAM, J. A. 1998b. Twenty-eight years of monitoring a breeding population of Carnaby's Cockatoo. *Pacific Conservation Biology* 4: 261–270.